U.S. Generating Company's Experience with SCR and SNCR on Coal-fired Generating Plants

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U.S. Generating Company is a wholly owned subsidiary of PG&E Corporation and is one of the nation's leading competitive power generators with more than 7000 MWs of generating capacity. Approximately 40 percent of this capacity are coal-fired generating plants with a substantial portion of this capacity utilizing SCR or SNCR NOx reduction technology.

Currently, U.S. Generating operates 3 pulverized coal plants with 4 units utilizing SCR systems and 3 plants, both pulverized coal and fluidized bed, with 7 units utilizing SNCR systems. In addition, at the present time 2 fluidized bed boilers are completing the installation and startup of SNCR systems. The operating plant history equates to over 18 operating years of SCR system experience and over 33 operating years of experience with SNCR systems. Through this time we have experienced many different and difficult problems which were successfully corrected. These plants are all meeting or exceeding their NOx emission requirements and can clearly be defined as leaders in the area of NOx control technology for either new installations or retrofit applications.

The problems faced on each unit were sometimes unique; however, many common approaches to problem solving can be applied. The following briefly identifies many of the issues and implementation strategies, which were applied.

Storage Systems

In many cases piping required reworking which included routing, sizing and selection of material. In some cases storage tanks were pressurized to improve the reliability of the pumping systems. In another, existing tanks were re-commissioned for use as reagent storage to take advantage of location and capacity to minimize overall project cost.

Vaporization Systems

It is very important to understand the design requirements of the ammonia or urea injection system, so that the vaporization system can be properly sized. This includes understanding the spray requirements, the load ramping profile of the unit and certainly the ambient conditions.

Ammonia/Urea Injection Grid

Modification of the injection grid on the SNCR systems and balancing of the grid on the SCR systems was required in some cases to maximize the efficiency of the system. The boiler operation along with the burner tuning, overfire air damper/register positions and fuel source must be reviewed at the same time to assure compatibility.

Feedback System Control

The initial control schemes for the SCR systems required extensive modifications due to the unreliability of the NH3 and the outlet NOx analyzers. The issues focused on plugging of the sample lines; whether the point source was representative of the SCR outlet and could be considered reliable to assure emission limits were not exceeded; and the potential for additional reaction occurring in the sample line so the analyzer was indicating NOx levels lower than in the duct. In order to solve these problems, several resolutions were studied prior to making the modifications to the control system to permit reliable automatic control to meet emission limits.

Catalyst Management Plan

It is important to monitor the NH3 levels in the ash and to conduct periodic catalyst sampling to determine the catalyst activity and expected replacement schedule. In order to properly predict the expected performance and remaining life, it is also important to understand the catalyst design, the poisons which affect the life of the catalyst, and the effect of the unit operating conditions on the catalyst. It is also important to understand the needs and to work with the catalyst suppliers to maximize the SCR performance. At the 3 U.S. Generating plants utilizing SCR, we have honeycomb type catalyst from IHI, plate type from Siemens and are presently installing Hitachi plate type catalyst. This has provided us a good opportunity to work with suppliers, and understand how their designs can most benefit U.S. Generating.

Sootblowers

The original design of the SCR systems utilized steam rake-type sootblowers. Several problems developed with this configuration particularly in the area of the rollers for the lances. Due to the timing of the problem at each of the plants, several solutions were implemented to correct the problems. In one case the rollers were redesigned using different material. In another case it was elected to install sonic air horns and remove the steam sootblowers. The sonic air horns were installed in different configurations on several elevations. In addition, air horns from 3 different manufacturers were installed. The air horn design and specification is slightly different in each vendor's case and we are evaluating the benefits of each one.

Intelligent sootblower controls are scheduled for installation on three SNCR installations to allow tighter control of flue gas temperatures entering the SNCR injection planes. Tighter control of furnace temperatures offers maximum reagent utilization while minimizing ammonia slip.

Air Preheater

The air preheaters at the plants utilizing SCR and SNCR systems are either tubular or Ljungstrom rotary type. While the tubular air preheaters did not experience any problems due to the SNCR systems, problems were experienced initially with the rotary type air preheaters due to ammonia slip. One unit experienced air preheater plugging problems, which required water

washing on an interval of approximately 8 to 12 weeks. As the problem was being evaluated and worked towards a resolution, it was decided to replace one section of the air preheater with two different designed baskets. The cold end was replaced with enameled baskets and the intermediate baskets were replaced with a loose pack design. The actual pluggage problem was traced to an underdesign of catalyst for the furnace NOx levels but we continue to monitor and assess the new air preheater baskets. Pluggage of horizontal shaft APH baskets at one SNCR installation is expected to be reduced by managing furnace exit gas temperatures through intelligent sootblower controls minimizing ammonia levels entering the air preheater.

Based on our significant years of experience with both SCR and SNCR technology, U.S. Generating can be considered a leader in this field. We continue to explore methods of improvement for these systems in order to increase our knowledge and maintain our leadership role in the operation of this technology. SCR and SNCR systems will continue to provide a long term and reliable means to effectively control NOx emissions at U.S. Generating Plants.